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all minds, from that of the lowest animal to that of the highest human genius" (p. 269). What is this mind, of which the author speaks? And what is meant later by the author's division of reality into 'the material world' and 'the mental world' (p. 271), or 'the material world' and 'the spiritual world' (ibid). If we are dealing with indissociable constituents of matter, would it not be as wise to speak of 'the material world' and 'the world of duration,' or 'the material world' and 'the world of motion?' But I waive these questions, as being possibly the products of a 'feverish dream.' It must be accepted as a general answer to all such, and a sufficient consolation to the discontented, that 'the simple and the true remain' (p. 271).

As a last word I may add that the more sober of the philosophers of our time have, notwithstanding 'the intoxication of illusion,' been accustomed to think that it is not prudent for a philosopher who has no special knowledge of the subject to venture into other fields, as, for example, that of anthropology. Some even go so far as to believe that it is not wise for an anthropologist to venture into philosophical discussions unless he has acquainted himself with the writings of those who have preceded him in work of that kind. Perhaps it is because they are 'immersed in thaumaturgy' that they find in such contributions to philosophical literature more heat than light.

GEORGE STUART FULLERTON.

UNIVERSITY OF PENNSYLVANIA, February 27, 1896.

THE TEMPERATURE OF THE EARTH'S CRUST.

IN the December number of the *Journal of Science* Prof. Alexander Agassiz gives the temperatures found at different depths in a well-known mine in the Lake Superior region, as follows:

At 105 ft.—59° F.

At 4580 ft.—79° F.

Or an increase of temperature of 1° F. for each 223.7 ft.

With this he compares Lord Kelvin's figures of 1° in every 51 ft; also the figures obtained in the St. Gothard tunnel, showing a rise of 1° for every 50 ft.

The Lake Superior figures would make the solid crust of the earth nearly 90 miles in thick-

ness, instead of Lord Kelvin's deduction of twenty miles.

Now I wish to suggest, as a tenable hypothesis, that the Lake Superior district having been far in the heart of the ice cap of the glacial period, the refrigeration of the crust of the earth penetrated to so great a depth that its effects *still linger*.

Take, for example, the 100° C. line, which normally is 9,000 feet below the surface. During the many thousand years of the ice cap this may have been forced downwards to a depth of, say, 40,000 ft. Since the removal of the ice, during, say, 7,000 years, the internal heat has been slowly rising towards the surface. But it has not yet had time to regain its former levels of temperature.

It would be interesting to ascertain what are the rates of increase of temperature now under regions where the subsoil is permanently frozen, as in the tundras of Siberia and Alaska.

It does not seem clear to me that the earth's crust necessarily became greatly thickened in the Superior region. The refrigeration need not have penetrated deeply enough for such an effect.

SERENO E. BISHOP.

HONOLULU, January 24, 1896.

THE X-RAYS.

SHORTLY after mailing my note of last week I took a photograph by means of the X-rays, using a Crookes' tube connected with an induction coil actuated by a make and break current, and therefore giving the electrodes a fixed polarity.

The photograph shows only one electrode which, from the manner in which the tube was connected, was the cathode, thus confirming the views expressed in my previous letter.

RALPH R. LAWRENCE.

BOSTON, March 5, 1896.

THE INSTINCT OF PECKING.

IN discussing Prof. Morgan's lecture on instinct it has several times been stated that chickens pecked instinctively, but had to be taught to drink. There was a note in *Nature* last year, concerning some species of Asiatic pheasants—it may possibly have been the Jungle Fowl—to the effect that the young did not

peck instinctively and did not offer to take food spread before them. The natives seemed well aware of this peculiarity, and in the particular instance recorded a native induced the young birds to peck by tapping on the ground with a pencil near the food. They seemed attracted by the sound and movement, and were thus induced to peck at the food. F. A. LUCAS.

SCIENTIFIC LITERATURE.

BRONGNIART'S PALEOZOIC INSECTS.

Recherches pour servir à l'histoire des Insectes fossiles des temps primaires, précédées d'une étude sur la nervation des ailes des Insectes. Saint Etienne, 1893. 2 v. 4°. Text, 493 pp.; Atlas, 44 pp., 37 folding plates.

These volumes, which are primarily devoted to the carboniferous insects of Commentry, France, form the most important work that has ever been published on paleozoic insects. Our knowledge of the older hexapods has heretofore been obtained piecemeal, and generally by exceedingly fragmentary researches; while here we are introduced at once to a wealth of material equalling, if it does not surpass, all previous knowledge of paleozoic insects. Mr. Brongniart had indeed published a few of his interesting finds in previous minor papers and had given also a summary account of the Commentry fauna in a brochure in 1885; but as the latter contained almost no details, and was merely a sketch of his classification (here modified in a few particulars), it had slight value except as a forecast of what is now realized.

Cockroaches form in all Carboniferous deposits the major part of the insect remains, and many hundreds of specimens have been obtained at Commentry. Leaving these out of account because reserved by the author for future publication (a few figures only without descriptions being given), the fauna of Commentry consists, according to Brongniart, of Neuroptera, Orthoptera and Homoptera; these he divides into 12 families or larger groups, ten of which are regarded as extinct, and they include 48 genera and 97 species, a number of species just about double that of the previously known European Carboniferous hexapods, exclusive of course of cockroaches.

The variety, novelty and striking character of the forms revealed is as interesting as their number. No one of them, indeed, can be regarded as extraordinary as *Eugereon*; but we are introduced to long-winged giants regarded by Brongniart as the precursors of the Odonata, but which in spread of wings make our largest dragon-flies appear as pigmies; one, *Meganeura*, has a spread of considerably more than two feet, and one specimen of this, which I have had the good fortune to see, is so well preserved that four nearly perfect and fully expanded wings are in place attached to the thorax; others have saltatorial hind legs as fully developed as in our existing Locustarians, but with very different wing neurulation. *Thyspanura* (before known fossil only from the Tertiary) are indicated—unfortunately not figured—which have but a single caudal seta; more than fifty specimens of this have been unearthed. Insects are found with a broad lobate expansion on either side of the prothorax, recalling some living Mantidæ (*Chœradodis*, etc.), but which, being filled with apparent nervures, Brongniart regards with too great confidence as prothoracic wings. Others, and these include a variety of types, have lobate appendages at the sides of all the abdominal segments, like the branchial gills of the larvae of some existing Neuroptera, persistent through life in Pteronarcys. There are also gigantic Mayflies, and Neuroptera of large size with caudal setæ more than six inches long. And, finally, we may mention undoubted cockroaches which show a straight, slender, Locustarian-like ovipositor half as long as the abdomen, an additional and striking difference to distinguish them from modern cockroaches.

Brongniart begins his work with a somewhat detailed historical review of discoveries in the field of paleozoic insects, with an appended bibliography, and follows it by an extended study of the neurulation of existing Neuroptera, Orthoptera and Fulgoridæ (180 pp.), as a basis for his attempt to classify the Carboniferous forms; 12 of the plates are also given to the illustration of the wings of modern insects. In this study he follows with some modifications the guidance of Redtenbacher, apparently unaware of some later studies on the subject,